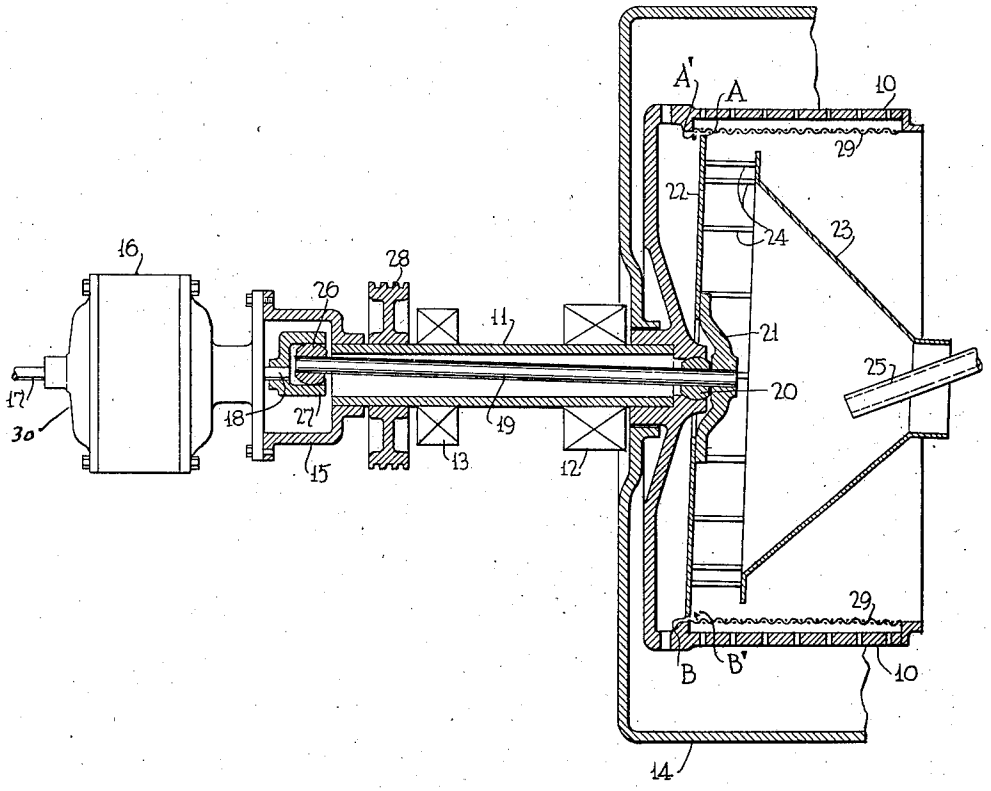
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CENTRIFUGAL SEPARATOR

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INVENTOR

Leo D. Jones.

BY Maurice A. Crouse

ATTORNEY

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CENTRIFUGAL SEPARATOR

Leo D. Jones, Philadelphia, Pa., assignor to The Sharples Corporation, Philadelphia, Pa., a corporation of Delaware

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The present invention pertains to the art of centrifugation, and includes a process and machine for dehydrating solids and separately discharging the solids and separated liquid from the zone of centrifugation. Machines of this type are especially useful, and are well known, in the art of separating crystals from a slurry in which they are contained.

Various schemes have heretofore been proposed for discharging solids continuously or in a sequence of rapid intermittent movements from a centrifugal rotor in which they are dehydrated. Such schemes have been subject to the objection that they entail a high degree of friction between the surface along which the solids travel and the discharging tool which is relatively rotatable with respect to such surface, or that they involve the use of relatively complicated mechanism for effecting the discharge.

A feature of the present invention consists in the fact that it provides a method and apparatus by which the solids are moved longitudinally of the rotor toward the discharge point without the use of complicated apparatus and without any relative rotation between the surface of the rotor along which the solids move and the tool by which they are discharged.

These results are attained by providing a disc which oscillates about axes at right angles to the axis of rotation of the rotor while rotating with the rotor. This oscillation is preferably in the nature of a compound movement providing a wobbling of the periphery of the disc for causing longitudinal movement of the solids, and is produced by a special mechanical movement as described hereinafter.

Further features of the invention, and the detailed character thereof, can be best understood by reference to the following specific description and the attached drawing, in which,

The single figure is a cross section through a centrifugal rotor including solids discharging mechanism designed in accordance with the invention.

The apparatus of the invention, in its preferred form, is illustrated in the drawing, and the nature of the apparatus and process features of the invention can best be understood by consideration of the apparatus there illustrated.

As illustrated in the drawing, the centrifugal rotor is attached to a quill 11, which rotates in bearings 12 and 13. The rotor is surrounded by a stationary casing 14, into which liquid removed from solids passes through perforations in the wall of the rotor, after passing through the screen 29.

A casing 15 surrounds the end of quill 11 remote from the rotor 10, and this casing is secured to the outer casing 16 of a speed reducing mechanism 30. This speed reducing mechanism includes a high speed shaft 17 and a low speed shaft 18, projecting from opposite ends of the casing. Any standard form of speed reducing mechanism designed to receive power from a high speed shaft such as 17 and transmit that power to a low speed shaft such as 18 may be employed in the practice of the invention.

A shaft 19 is mounted in a self-aligning bearing 20 on the axis of the rotor 10, and a flange 21 is secured to the end of the shaft 19 within the rotor. A disc 22 designed to effect discharge of solids from the rotor is secured to the flange 21, and the outer circumference of this disc lies in close proximity to the screen 29, with sufficient clearance to permit oscillating movement of the disc relatively to the screen in a manner which will be described hereinafter.

A conical feed tube 23 is secured to the disc 22 by a number of rods 24. A pipe 25 is provided for feeding mixtures of liquid and solids to the rotor, and the inner end of this pipe projects into the conical feed tube 23.

The end of the shaft 19 is connected to a ball 26 mounted for free rotation with respect to a socket 27 eccentrically mounted upon shaft 18, the self-aligning bearing connection between ball 26 and its socket permitting free rotation of shaft 19 with respect to socket 27 and movement of the axis of this shaft as described hereinafter. The quill 11 and other rotating parts derive their power from pulley 28, as will be evident from the following description of the operation of the machine.

In operation, power is applied to the drive pulley 28, and this causes rotation of the quill 11 and rotor 10. The mixture to be treated is then passed to the rotor, being passed into contact with the screen 29 through the annular passage defined by the feed tube 23 and disc 22. The disc 22 may be caused to rotate at the same speed as the rotor by frictional contact between the screen 29 and solids, on the one hand, and the solids and the disc 22 on the other, or this result may be accomplished by a driving connection at the bearing 20. In either case, the disc 22 will be rotated at substantially the same speed as the rotor, and a wobbling motion will also be imparted to this disc. The manner in which this oscillatory or wobbling motion is attained will be evident from the following discussion.

Let us first arbitrarily assume that the rotor 10 and disc 22 are held stationary, while the shaft 19 is also prevented from rotation, during rotation of the socket 27 about the axis 18. It is self-evident that, under these conditions, movement of the disc 22 would occur during rotation of the socket 27, with the result that, after one-half revolution of the socket 27, the point A on the circumference of disc 22 will have moved to A' and the point B to B', and that these points will return to A and B respectively, thereby completing one complete movement of rotary oscillation through a small arc, in one complete revolution of the socket. The same sort of movement also occurs when the socket 27 is held stationary and the rotor 10 and disc 22 are rotated. In fact, when any condition of relative rotation between the rotor 10 and socket 27 exists, i. e., whenever either the socket is stationary with the rotor and disc rotating, or the socket is rotating at a rate different from the rate of rotation of the rotor and disc, a similar movement occurs. In the latter case, the rate of wobble of the disc is equal to the rate of relative rotation between the socket 27 on the one hand, and the disc 22 and rotor 10, on the other.

In the preferred operation of the embodiment of the invention illustrated in the drawing, when power is applied to pulley 28, effecting rotation of the casing 16 of the speed reducer 30, the shaft 17 of the speed reducer is held stationary, with the result that the shaft 18 and socket 27 are rotated at a speed which is slightly different from the speed of the rotor 10 and disc 22, with the result that, as the rotation of the rotor 10 and shaft 19 continue, and the relative differential speed between these elements and the socket 27 is maintained, a wobbling motion of the disc 22 occurs, in such a manner that the solids are progressively expelled from the rotor without relative rotation between the disc 22 and the screen 29. Thus, by the time a half revolution of relative rotation between the socket 27 and the rotor 10 has occurred the point A on the disc will have moved longitudinally with respect to the rotor wall to the position A' and the point B to the position B', and by this motion solids occupying the space longitudinally adjacent to point B will be shoved toward the solids discharge outlet from the bowl. This shoving action will be progressive from point to point around the circumference of the disc 22 as the rotation of the rotor 10 and the relative rotation between this rotor and the socket 27 continue.

Instead of maintaining the shaft 17 stationary, this shaft may be rotated in order to vary the rate of relative rotation between the socket 27 and the rotor 10, if desired. As a still further alternative, the socket 27 may be maintained stationary, as by omitting the speed reducer 16 and attaching the socket 17 to a fixed support, and in such case, the rate of wobbling of the disc 22 will be equal to the rate of rotation of the rotor, one complete oscillation of the disc relative to the rotor occurring during each rotation of the rotor. The embodiment in which the socket 27 is rotated to reduce the rate of wobble is, however, greatly preferred.

Various modifications are possible within the scope of the invention, and I do not therefore wish to be limited except by the scope of the following claims.

I claim:

1. In a centrifugal separator designed to separate liquid from solids and discharge the solids by moving them longitudinally through a centrifugal rotor, the combination comprising a rotor, means for feeding a mixture of liquid and solids into said rotor, a disc within said rotor having its outer circumference adjacent the surface of said rotor along which the solids accumulate, a shaft secured to said disc, means for maintaining said shaft disaligned with respect to the rotor axis while progressively moving the axis of said shaft about the axis of said rotor at a rate different from the rate of rotation of said rotor, and said disc and shaft being designed to be rotated at the speed of rotation of the rotor, whereby to impart to said disc, upon rotation of said disc with said rotor, a wobbling motion with respect to the rotor and impel the solids longitudinally from the rotor.

2. In a centrifugal separator designed to separate liquid from solids and discharge the solids by moving them longitudinally through a centrifugal rotor, the combination comprising a rotor, means for feeding a mixture of liquid and solids into said rotor, a disc within said rotor having its outer circumference adjacent the surface of said rotor along which the solids accumulate, a shaft secured to said disc, means for maintaining said shaft disaligned with respect to the rotor axis while progressively moving the axis of said shaft about the axis of said rotor at a rate differing from the rate of rotation of said rotor by an amount which is less than the rate of rotation of said rotor, and said disc and shaft being designed to be rotated at the speed of rotation of the rotor, whereby to impart to said disc, upon rotation of said disc with said rotor, a wobbling motion with respect to the rotor and impel the solids longitudinally from the rotor.

3. In a centrifugal separator designed to separate liquid from solids and discharge the solids by moving them longitudinally through a centrifugal rotor, the combination comprising a rotor, means for feeding a mixture of liquid and solids into said rotor, a disc within said rotor having its outer circumference adjacent the surface of said rotor along which the solids accumulate, a shaft secured to said disc and intersecting the rotor axis, said disc and shaft being designed to be rotated at the speed of rotation of the rotor, a bearing for a part of said shaft longitudinally removed from the part of said shaft which intersects the axis of the rotor, said bearing being disaligned with respect to the axis of the rotor and designed to permit oscillation of said shaft, and means for rotating said bearing about the axis of the rotor at a rate different from the rate of rotation of said rotor, whereby to effect a progressive wobbling movement of said disc with respect to said rotor and impel the solids longitudinally from the rotor.

LEO D. JONES.